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NOTES ON SOME NEW RHODONITE SPECIMENS FROM FRANKLIN FURNACE, NEW JERSEY

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and

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The rhodonite of a recent find at Franklin Furnace, N. J., presents such an unusual habit and appearance that specimens have been sent to the writers for identification, by Col. Roebling, R. B. Gage, F. A. Canfield, and Ward's Natural Science Establishment, and the identification of the mineral as rhodonite has been reluctantly accepted by the connoisseurs of New Jersey minerals. For this reason and because the material presents several features of interest, an analysis of the rhodonite and brief description of the associated minerals are presented herewith.

The specimens consist of drusy surfaces from the lining of narrow, partly open seams cutting fine banded franklinite-willemitite ore. The minerals deposited in these seams, and evidently later than the enclosing ore, include zoned rhodonite, yellow axinite, white barite, willemitite crystals, and a radiated brown mineral which has not yet been definitely identified.

The rhodonite occurs in freely developed crusts made up of prismatic forms which reach 3 millimeters by 5 millimeters in size and have an elliptic cross section and serrated edges. They are terminated by a lustrous and somewhat curved face. When closely examined these are seen to have a lozenge shaped core of deep pink rhodonite surrounded by an outer zone made up of small crystals of a paler or more brownish color, the contact between the two zones being sharp. The core shows fine polysynthetic twinning, although the major portion has a single orientation, the laminae in twin position being very thin. The outer zone, although

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made up of numerous small crystals, shows no twinning and extinguishes as a unit, indicating that its component crystals are in exactly parallel position. The three prominent cleavages shown by the mineral extend uninterrupted through inner and outer zones alike, showing that there is perfect crystallographic continuity, the difference in extinction ($\pm 10^\circ$) between the core and the outer zone being attributed to change in optical orientation with change in composition. The three cleavages are perfect and about equal in prominence. Of these, one is parallel to the curved lustrous face shown by the mineral, while two are in the zone approximately perpendicular to this face. Of the latter, one coincides exactly with the plane of the polysynthetic twinning, while neither is parallel to the crystal faces which make up the serrations of the outer crust. By carefully splitting out cleavage fragments and measuring them on the goniometer it was found that the curved terminal face of the groups is the form $M(1\bar{1}0)$ and the twinning plane is $c(001)$, while the bounding faces of the outer crust are pyramids in the zone $m(110) \wedge m'(1\bar{1}0)$, probably $q(221)$ and $n(2\bar{2}1)$, (Dana's orientation). This orientation assumed, the angles measured on the cleavages compare as follows with the angles given for rhodonite by Dana:

	MEASURED	CALCULATED
$m(110) \wedge M(1\bar{1}0)$	92° 40'	92° 28'
$c(001) \wedge m(110)$	67° 03'	68° 45'

The prominent cleavages thus are parallel to the planes $c(001)$, $m(110)$ and $M(1\bar{1}0)$.

A sample consisting of the core portion of these rhodonites was separated for analysis, the analyzed powder being found by optical examination to contain less than 1 per cent of the material of the outer zone. The results of the analysis are as follows:

SiO ₂	44.76
FeO.....	.99
MnO.....	40.83
CaO.....	10.12
ZnO.....	3.26
MgO.....	.76
Ignition.....	.06
Total.....	100.78

This analysis indicates a rhodonite of ordinary composition, being slightly higher in lime and a little lower in zinc than the

normal Franklin Furnace fowlerite. The material of the outer zone could not be separated from the specimens available in amount sufficient for analysis, but its optical properties show that it also is a rhodonite but, as shown by the lower indices of refraction, higher in lime than the inner core. It thus grades toward the highly calciferous bustamite recently described by the writers.² It is hoped that enough of these zoned rhodonite crystals can be secured to separate the material of the outer zone for an analysis. If any one has material they are willing to sacrifice, the authors will undertake the separation and analysis.

The microscope shows that the two zones are separated by a rather sharp boundary after the manner of zoning in some feldspars. The material analyzed was essentially homogeneous and was made up of 99 per cent of the central pink zone. Its optical properties are: Optically+, 2V moderately large, dispersion $\rho < \nu$ easily perceptible, crossed dispersion rather strong.

$$\alpha = 1.716$$

$$\beta = 1.720$$

$$\gamma = 1.732$$

Sections normal to the most perfect cleavage are at about right angles to the composition plane of the twin lamellae and to two other cleavages whose traces are at an angle of about 68°. The poorer of these two cleavages is parallel to the twin lamellae. Such cleavage fragments show unsymmetrical extinction and the main cleavage piece gives extinction angles of about 22° measured against the trace of the twin lamellae and show the emergence of an optic axis just out of the field of the microscope. The other small twin lamella gives somewhat larger extinction angles. Fragments lying on the other cleavage that shows the twin lamellae also gives unsymmetrical extinction at small angles.

A specimen kindly lent the authors by Col. Roebling has the outer, nearly colorless zone better developed. The optical properties of the inner zones are: Optically+, 2V large, crossed dispersion strong;

$$\alpha = 1.708$$

$$\beta = 1.716$$

$$\gamma = 1.724$$

Those of the outer, nearly colorless zone are: Optically+, 2V moderate, dispersion slight, crossed dispersion strong;

$$\alpha = 1.687$$

$$\beta = 1.692$$

$$\gamma = 1.709$$

These properties indicate a rhodonite near bustamite, although the birefringence is rather high.

² *Am. Min.*, 7, 95, 1922.

The willemite which occurs on one specimen of this rhodonite is in pale green to colorless transparent hexagonal crystals showing only the unit prism and the basal pinacoid. These crystals reach an extreme length of 6 mm. with a diameter of 1 mm. They rest upon the rhodonite. Optically they are uniaxial and positive, with $\omega = 1.690$ and $\epsilon = 1.720$, approximately.

The axinite is abundant as sheaves of bright yellow crystals aggregated in approximately parallel position. It is the characteristic yellow axinite from Franklin. The largest crystals reach 15 mm. in length.

Barite occurs as transparent, colorless to white cleavable masses, having normal optical properties.

One mineral occurs on four specimens of the rhodonite which it was not possible to identify. This is doubtless a new hydrated manganese silicate. It forms rosettes of acicular radiating needles and blades of a brown color which rest upon, and are evidently later than, the rhodonite. The rosettes reach an extreme diameter of 20 mm. with individual blades 10 mm. by 1 mm. Optically the mineral is biaxial and negative, with $2V$ very small; dispersion $\rho < \nu$ rather strong; indices of refraction, $\alpha = 1.563$, $\beta = \gamma = 1.593$; $\gamma - \alpha = .030$. Under the microscope the mineral is transparent and colorless, and is in the form of thin flat laths. The optical direction Z is nearly perpendicular to the flat face of these, Y nearly parallel to the length, and X nearly perpendicular to the thin edge. Other cleavages apparently bevel the edges of these laths. Sections perpendicular to the acute bisectrix appear to show about parallel extinction. Sections perpendicular to Z show twinning with the composition plane perpendicular to the face and parallel to the length and give symmetrical extinction of about 2° . The only silicate minerals known which approach these optical properties are certain micas, from which this mineral differs in other respects. In the forceps the mineral melts in the flame of a bunsen burner to a brown transparent glass bead and yields neutral water at a moderate temperature in the closed tube. With borax in the oxidizing flame it yields the purple bead of manganese. It is decomposed by hydrochloric acid with separation of skeletons of silica and the solution contains only a trace of iron, very little alumina and no lime, but abundant manganese. The presence of zinc could not be established in the very small amount of material available for testing. It is hoped that enough of this material for analysis may be obtained at some future time.

THE OPTICAL PROPERTIES AND MORPHOLOGY
OF BISBEEITEAUSTIN F. ROGERS, *Stanford University*

The object of this article is to place on record a second occurrence of bisbeeite, a hydrous copper silicate, $(\text{CuSiO}_3 \cdot \text{H}_2\text{O})$, described not long since by Schaller¹ and also to define more accurately the optical properties of this rare mineral. In addition it has been possible to determine the crystal system as orthorhombic.

The locality for the new occurrence of bisbeeite is the Grandview Mine in the Grand Canyon, Arizona. A specimen collected by Mr. E. A. Melczer, a former student of the writer, furnishes the material on which this note is based. It occurs in minute (1–2 mm.) imperfect spherulites disseminated through the outer portion of a reddish-brown oxidized copper ore. The specimen contains a small amount of an unidentified green copper mineral and also residual specks of chalcocite.

The color of the bisbeeite is Ridgway's² 47a (between methyl blue and light methyl blue). It was provisionally labelled "azurite pseudomorph after malachite," but is soluble in nitric acid without effervescence. In the closed tube it turns black and yields water when heated. Qualitative tests for copper were obtained and optical tests prove its identity with bisbeeite. Altho a silicate, it is noteworthy that fragments of the mineral are soluble in a molten sodium metaphosphate bead. As Moses and Parsons³ have suggested, a satisfactory blowpipe test for silica is needed.

OPTICAL PROPERTIES: The spherulites are readily separable into fibers which have parallel extinction and as a rule are pleochroic from pale blue to deeper blue. The elongation is parallel to the slower ray in all cases. The indices of refraction, which were determined by the indirect or immersion method in sodium light, are as follows: $n_\gamma = 1.649$, $n_\beta = 1.620$, $n_\alpha = 1.589$, all ± 0.001 ; $n_\gamma - n_\alpha = 0.060 \pm 0.002$. The values given by Schaller are $\gamma = 1.65$ and α or $\beta = 1.59$, which together with the chemical tests,

¹ *Jour. Wash. Acad. Sci.*, **5**, 7, 1915.

² Color Standards and Nomenclature, Washington, 1912.

³ Mineralogy, Crystallography and Blowpipe Analysis, 5th edition, p. 192.

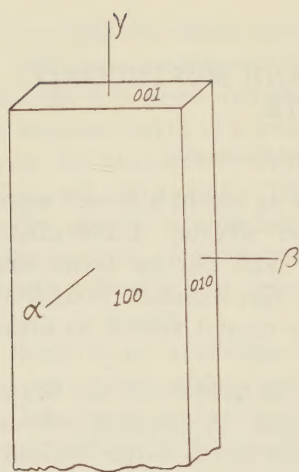


FIGURE 1.

EUHEDRAL CRYSTAL OF BIS-BEEITE, SHOWING OPTICAL ORIENTATION

prove the identity of the mineral in question with the original bisbeeite.⁴ The axial colors of the bisbeeite are as follows:⁵ γ =rather deep blue, β =pale bluish green, α =neutral. The absorption scheme is $\gamma > \beta > \alpha$. The bisbeeite is probably optically positive.

MORPHOLOGY: The ends of some of the minute acicular crystals project into cavities; they for the most part have indefinite terminations, but a few have a form similar to that shown in Figure 1. The forms present are the three pinacoids: (100), (010), and (001). The optical orientation is: $a = \alpha$, $b = \beta$, and $c = \gamma$. If the observations are correct bisbeeite is orthorhombic in crystallization.

THE BELLEVILLE COPPER-MINE

GEORGE F. BLACK, *Newark Mineralogical Society*

The Schuyler Copper-mine at North Arlington, New Jersey, is believed to be the oldest in the United States. It is situated on property secured by Captain William Sanford of the British Army by a patent, issued on July 4th, 1668, conveying to him about ten thousand acres of meadow-land and five thousand three hundred acres of the higher ground lying between the Hackensack and the Passaic Rivers. Nathaniel Kingsland, sergeant-major of the island of Barbados, later became interested in this grant, and from him the eastern half of the town of Lyndhurst takes its name. Sometime about the year 1712 or 1713 the discovery that copper existed in the rock appears to have been made by Arent Schuyler (1662–

⁴ Larsen's (*U. S. Geol. Surv., Bull.* 679, 48, 1921) values for the indices of refraction of bisbeeite are: $\alpha = 1.615$, $\beta = 1.625$, $\gamma = 1.71$, all ± 0.01 . It is doubtful whether he worked with the original mineral.

⁵ γ , β , and α are axial directions of the index ellipsoid and n_γ , n_β , and n_α , the values of the indices of refraction for these directions.

1732) who had purchased the tract from Kingsland. The exact date when the deposit began to be worked is not known, but Robert Hunter, Governor of the united colonies of New York and New Jersey, writing from New York in November, 1715, to the Lords of Trade in Great Britain, said: "There being a Copper Mine here brought to perfection as you may find by the Custom House books at Bristol, where there was imported from this place about a Tonn in the Month of July or August last, of which Copper farthings may be coyned."¹ In April, 1721, there were one hundred and ten casks of ore from this mine shipped from New York to Holland. This shipment caused much concern to the Lords of Trade, who suggested that the matter should be laid before Parliament in order that such shipments "be prevented by some act to be passed for that purpose." Nine years later, so leisurely did they proceed in those days, the Governor, John Montgomerie, had a conference with Col. John Schuyler regarding such shipments and found him unwilling to aid in the matter beyond promising that when his ships arrived in England with the ore the English Copper Company should have first sight of it.² In August, 1734, the New Jersey legislature imposed a duty of forty shillings per ton on all copper exported from the province not directly to Great Britain. Strangely enough this measure was opposed by the English Copper Smelters because it was found that the law was evaded by shipping the ore to New York and thence to England or other countries. The Bristol traders feared that imposing "such a Duty may be a Great discouragement to the seeking after the Oare the same being brought home to be refined and manufactured and if discouraged by a Tax abroad it will consequently lessen your Majestys Revenue at Home, the Copper and Brass Manufacturers of this Kingdom and the Trade and Navigation to the American Plantations."³

For many years the mine yielded large quantities of rich ore, but in time the workings reached a depth beyond which hand and horse-power could not keep it clear of water. When first worked the yield averaged about one hundred tons per annum and the mine returned a substantial profit to its owners, and it is stated that from the books of the discoverer, it appears that before the

¹ *Documents relating to Colonial history of New Jersey*, 1 ser., 4, p. 222.

² *New Jersey Archives*, 5, pp. 7, 9, 267.

³ *Ibid.*, 5, p. 377.

year 1731 he had shipped 6933 casks making about 1386 tons to the Bristol Copper and Brass Works. Writing about the year 1750 William Douglass, in his *Account of the British Settlements in North America*,⁴ says "Schuyler's copper ore is from a Mine in Jersies but exported from New York. . . . The Cartage to Hudson's River is short, and their first Agreement with the Miner, was to allow him one-third of Ore for raising and laying it above Ground; it was done up in quarter Barrels, whereof six made a Tun. The richness of this Copper Mine made so much Noise in the World, that a few years since, to engross this Ore for the benefit of Great Britain, it was by Act of Parliament enumerated; but lately it has not been Wrought and Exported, as appears by the quarterly accounts of the Custom-House of New York."

In 1749 the mine was visited by Benjamin Franklin,⁵ and on February 13th of the following year he wrote to Jared Eliot from Philadelphia: "I know of but one valuable copper mine in this country, which is that of Schuyler's in the Jerseys. This yields good copper and has turned out vast wealth to the owners. I was at it last fall, but they were not then at work. The water is grown too hard for them, and they waited for a fire-engine from England to drain their pits. I suppose they will have that at work next summer; it costs them one thousand pounds sterling." The pumping engine ordered from England in 1748 or 1749 was not shipped to the mine until about four years later, in September, 1753.

In 1761 the mine was leased by a new company, with Josiah Hornblower, the young engineer who brought over the pumping-engine and set it up, as their mine expert. The engine-house was soon after burnt down but rebuilt, and the mine worked for four years with, it is said, "great advantage and profit." In 1765 a workman, who had been dismissed for some reason, in revenge set fire to the engine-house in consequence of which the works were discontinued for a number of years. It was not till 1793 that another company was formed which undertook the work with a great show of energy. Beyond clearing out the rubbish which choked the drifts and levels and getting the old engine once more into working order, they appear to have confined their

⁴ *Account of the British Settlements in North America*, 2, pp. 257-258, Boston, 1751.

⁵ Writings, ed. A. H. Smith, 3, p. 1, 1905.

energies to forming a company and selling stock. A prospectus issued by them stated that "The ore of the Schuyler's mine yields, in each hundred pounds of copper, from four to seven ounces of silver, and like most copper ores, a small portion of gold," and they add, "At the time when pure copper was sold in England at seventy-five pounds sterling per ton, the ore of Schuyler's mine was shipped for England at New-York at seventy pounds sterling per ton." If the statement were true about the amount of silver found in the mine it would have been much more profitable to have worked the mine for silver alone, as such a production of that metal would equal the output of some of the most productive silver mines of the world.

During the early years of the nineteenth century it is believed that the mine was worked spasmodically, but for six years, from 1859 to 1865, it is said that upwards of two hundred workmen were employed in the mine and mills. In 1900 an expensive mill and reduction plant were set up, but short experimental runs proved that it was not adapted to the ore, and since then the mine has lain idle.

Kümmel, in his annual report to the Geological Survey in 1897, speaking of this mine says: "It must be confessed that the outlook for valuable copper deposits in these rocks is not encouraging. Nothing was observed in the course of this survey to warrant the inference that in the future prospecting for copper would be more remunerative than in the past."

Forty-two shafts are said to have been sunk on the property, but only one, called the Victoria shaft, has been kept open. This main shaft is said to be about 350 feet deep, but all is mud and rubbish below the 240-foot level and difficult of access. The old Cornish pump, considered a wonderful piece of mechanism in its day, is believed to be still in position at the bottom of the shaft buried in the mud. Three drifts from the bottom of the shaft are said to exist, one towards the northwest about 180 feet long, one to the southwest also 180 feet long, and the third running south for about 210 feet. There are also three drain tunnels, one of which drains the mine to the 100-foot level. Two inclines have been run in from the face of the bluff overlooking the meadows. One of these is 220 feet long and the other 80 feet.

The ore found at Arlington is chalcocite or copper glance with much secondary chrysocolla and smaller amounts of malachite.

Small amounts of azurite and cuprite have been found, along with occasional particles of native copper.

The ore occurs in unaltered grey or nearly white arkose sandstone in greater part adjacent to dikes and intrusive sheets of trap although no dikes or sheets of this rock appear at the surface. There are two layers of this arkose sandstone, the lower one about ten feet thick and the upper one about twelve feet separated by about one foot of shale. The copper ores have originated from hot copper solutions, probably of magmatic origin, deriving both their heat and their copper salts from the underlying Palisades trap sill and its offshoots. "The deposition of chalcocite," says Prof. Volney Lewis,⁶ by the heated waters near the intrusive, and of native copper with minor amounts of glance in the more remote, cooler regions, has in both cases doubtless been chiefly the result of cooling, supplemented perhaps in part by reactions with the calcite of the shales. The conditions of considerable accumulation have been supplied by some relatively impervious member, a dense shale or a trap sheet, which has sufficiently impeded the movements of the uprising solutions to permit considerable cooling, and, therefore, extensive deposits, and also to allow time for any possible reactions with the calcite and for leaching out the ferric iron, in part, by the acid waters."

AN UNUSUAL DIAMOND CRYSTAL

LEWIS S. RAMSDELL, *University of Michigan*

A short time ago Professor H. F. Cleland, of Williams College, sent to the Mineralogical laboratory a portion of a diamond crystal which proved to be of considerable interest. The specimen was hollow, and it was desired to determine whether or not the cavity had originally contained another diamond. Not only was this cavity unusual, but in addition two faces were found which represent a new form for the diamond.

The portion submitted for examination had been sawed from a larger stone, concerning which no information is available. As shown by the drawing (Fig. 1), this portion consisted of one half of an octahedron, and was about 5 mm. across. The octahedron was the predominant form, together with a well developed hexoctahedron (541), and in addition there were two small hexoctahedron faces which gave the indices (975), and which are desig-

⁶ Copper deposits of the New Jersey Triassic, *Econ. Geology*, 2, p. 257.

nated by the letter *H* in the drawing. These latter faces were sharply defined, and gave fair signals on the goniometer, with the following results:

SYMBOL	MEASURED ANGLES		CALCULATED ANGLES	
	ϕ	ρ	ϕ	ρ
957	60°50'	55°11'	60°57'	55°47'
975	51°35'	66°27'	52°07'	66°20'

The cavity, as shown in the diagram (Fig. 2), occupied the whole interior of the crystal, and its sides were parallel to the octahedron faces. The edges were sharp, and except for some triangular markings, the walls were smooth and gave definite single reflections. Judging from the evidence available, it seems highly probable that this cavity originally contained another diamond.

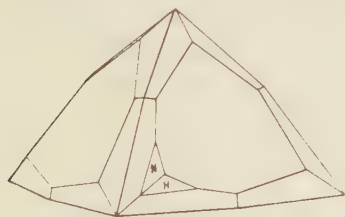


FIGURE 1.

DIAMOND SHOWING NEW FORM (975)

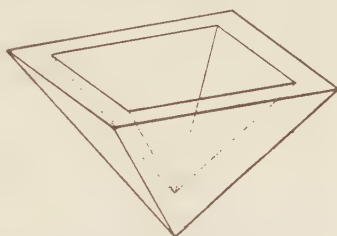


FIGURE 2

DIAMOND WITH OCTAHEDRAL
DEPRESSION

A cavity caused by solution would tend to be irregular, with rounded edges, and would necessarily be at the surface and not at the center of the crystal. Likewise in the case of a cavity formed by skeletal growth, we would expect a compact center, with depressions or cavities on the faces.

Cavities formed by foreign inclusions, such as carbonaceous or chloritic material, hematite, and liquid CO₂ are not uncommon, but it is hardly conceivable that any of these could produce such a regular depression as this one under consideration.

Inclusions of extremely small diamonds have been observed, and in at least one case the occurrence of a good sized crystal has been definitely reported.¹ Such an explanation seems in accord with the evidence available, and is the one which was given in the report. In view of the uncertainty concerning the origin of the diamond, it seems useless to conjecture as to how such a type of crystal might have been formed.

¹ G. S. Williams, Diamond Mines of South Africa.

BOOK REVIEWS

CRYSTALLOGRAPHY AND PRACTICAL CRYSTAL MEASUREMENT. A. E. H. TUTTON. 8-vo, two volumes. Vol. I, Form and Structure, XVIII + 746 pages, with 589 text figures and index; Vol. II, Physical and Chemical, VIII + pages 750 to 1446, with 342 text figures and index for both volumes. Macmillan and Company, Limited, *London*, 1922. Price \$35.00.

These volumes constitute a most noteworthy contribution to the literature of crystallography, especially in the English language. They are based upon the first edition, which appeared in 1911, just prior to von Laue's startling discovery in 1912, since which time such remarkable advances in our knowledge of crystal structure have been made. All of the material and illustrations of the author's monograph, CRYSTALLINE STRUCTURE AND CHEMICAL CONSTITUTION, now out of print, have been incorporated in this edition. Furthermore, so much new material has been added, that it became necessary to issue the work in two volumes. Obviously, it is impossible in so short a review, as this must necessarily be, to adequately stress all of the excellent features of the work, for the various phases of crystallography are presented in a very exhaustive manner. An endeavor has also been made to have the material up-to-date.

Volume I, CRYSTAL FORM AND STRUCTURE, is divided into two parts: (a) CRYSTAL FORM AND GONIOMETRY, and (b) CRYSTALLINE STRUCTURE AND ITS X-RAY ANALYSIS. In Part I, the fundamental laws, the geometrical properties of crystals, and the various methods of measurement are discussed in great detail. Part II is one of the most important sections of the book, since it contains chapters summarizing the advances made since the introduction of X-ray analysis. This is clearly seen from the following list of subjects considered in this part:—Composite Crystals and Twinning; Cleavage, Gliding; Asterism; Hardness; Crystal Viscosity; Foam Cell and Pulsation-Cell Theories; Crystals as Homogeneous Structures; Density, Volume, and Structure; 14 Space Lattices; Molecular Distance Ratios; 65 Regular Point Systems and the 230 Space Groups; Determination of the Density of Crystals and Calculation of Volume Constants; X-ray and Crystal Structure; Absolute Measurement of the Dimensions of the Space Lattice Cell,—Methods of Laue, Bragg, and Debye and Scherrer; Law of Atomic Diameters; Fedorov's Theory of Cubic and Hypohexagonal Types and of the Correct Descriptive Setting of Crystals; His Method of Crystallochemical Analysis; Theory of Pope and Barlow; Moseley's Law, Atomic Number and Atomic Structure.

Volume II, PHYSICAL AND CHEMICAL, is also made up of two parts, III and IV. Part III, which is given over to CRYSTAL OPTICS AND MICROSCOPY, contains a systematic discussion of the optical properties of crystals and the methods involved in their determination. CRYSTAL CHEMISTRY AND DEFORMATIONAL PHYSICS AND ITS INTERFEROMETRY are the general subjects assigned to Part IV. Here, isomorphism and related topics, the thermal, elastic, electrical, and magnetic properties of crystals, and "liquid crystals" are treated.

The price, \$35.00, for the two volumes, which are excellent examples of the printer's skill, is practically prohibitive from the standpoint of private ownership. The work is, however, indispensable to teachers of and workers in mineralogy and the allied sciences, and should therefore be added to all scientific libraries.

EDWARD H. KRAUS.

DIE KRISTALLE ALS VORBILDER DES FEINBAULICHEN WESENS DER MATERIE. FRIEDRICH RINNE. 8-vo. 101 pages, with 5 plates and 100 figures. Borntraeger Brothers, *Berlin*, 1921.

This is an excellent survey of our present knowledge of the structure of matter, and can be recommended heartily to all students of mineralogy, physics, and chemistry interested in this important field of investigation. The treatment is very concise, and all phases of the subject have been covered. It is to be regretted that a complete bibliography was not included.

Aside from a short introduction, this little volume contains 14 chapters. There is also a very brief section devoted to concluding remarks. The subjects discussed include:—Leptonology (the study of the fine or ultimate structure of matter), Leptonological units of matter, General outline of the ultimate structure of matter, Metamorphosis-series of matter, General tectonic arrangement of the fine structure of matter, Relationship of the ultimate structure of mixed crystals and intergrowths, Morphotropy and topotropy, Isotypy, Crystal growth and solution, Chemical processes based upon observations on crystals, Analogy between the morphological effect of physical and chemical fields upon crystal structure, and Physiology of crystals and types of atoms.

The numerous text-figures are an important feature of this timely treatise. Sepia prints of Röntgen, Groth, von Laue, and Schönflies appear as full page plates.

E. H. K.

NOTES AND NEWS

NOTE ON AN UNUSUAL CARBONACEOUS SUBSTANCE. A rather interesting carbonaceous substance was recently sent to the Mineralogical laboratory of the University of Michigan by Mr. J. Moyer of the North Dakota Agricultural College. The accompanying letter stated that it was from an arid part of North Dakota, and was the residue formed by the evaporation of a peculiar black water which had seeped thru lignite to the surface.

The substance is soft and dark brownish black in color, somewhat resembling dried muck. It is unusual in being rapidly and completely soluble in water, giving a dark brown and almost opaque liquid, all of which passes readily thru a quantitative filter paper, and reacts alkaline to litmus. It is insoluble in alcohol, ether, or benzene. It does not melt, but when heated first gives up water, then a combustible gas, and finally the fixed carbon burns off and leaves a rather large amount of yellowish ash. Qualitative tests indicate that the ash is principally sodium carbonate.

The original material liberated CO_2 with HCl , but the carbonaceous portion did not dissolve. After leaching out all the ash with acid, the residue was insoluble in water, but immediately went into solution when sodium bicarbonate was added.

Evidently the material is of the nature of a "humus acid," with a large proportion of sodium carbonate ash. The alkali carbonate dissolves when the material is placed in water, and the resulting liquid takes the humus compound into solution. It is well known that humus acids are held in solutions by alkali carbonate waters. The carbonaceous substance was probably leached out of the lignite by alkaline water, and was precipitated, by evaporation, with enough sodium carbonate to act as the solvent when pure water was again at hand.

EDW. F. HOLDEN.

We are informed through "Science" (July 21, 1922, p. 68) of a new and important occurrence of magnesite in southern Nevada, a few miles above the town of St. Thomas. The deposit occurs in Clark County, in the valley of Muddy River, which is one of the tributaries of the Virgin River.

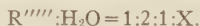
The material is porcelain-white, fine grained and massive, is remarkably free from foreign material, and has the general appearance and conchoidal fracture that are so characteristic of magnesite. It is not as hard as the more typical specimens as it crumbles rapidly on exposure to the weather. Because of this tendency the material has been known for some time as kaolin.

The deposit is included between tilted beds of conglomerate and sand-stone below and shale above. It is estimated that the beds aggregate two hundred feet in thickness and have an extent of one mile at least.

The first meeting of the newly formed Association of Maine Geologists was held on August 11th in Auburn and Lewiston. The local committee arranged a program that included all points of geological interest in the vicinity. These included Mt. Apatite, the source of much of the feldspar, many of the Maine gems and a large variety of minerals; also the Lewiston Falls and a number of other localities.

NEW MINERALS: NEW SPECIES

FAMILY: PHOSPHATES, ETC. DIVISION: PROBABLY $R''\text{:}R''''$:



Dewindtite

ALFRED SCHOEP: Sur la dewindtite, nouveau minéral radioactif. (On dewindtite, a new radioactive mineral.) *Compt. rend.*, 174(9), 623–625, 1922.

NAME: In memory of Dr. Jean Dewindt, a Belgian geologist.

CHEMICAL PROPERTIES: *Formula*, probably $PbO\cdot 2UO_3\cdot P_2O_5\cdot 3H_2O$ or $Pb(UO_2)_2[3H_2O](PO_4)_2$, a lead-phosphorus low water member of the uranite group. [Author gives a more complicated formula, but it is hardly justified by the analysis, which was made on impure material.] Theory, PbO 22.5, UO_3 57.7, P_2O_5 14.3, H_2O 5.5%. Analysis on material washed out of the torbernite which it impregnates, but not separable from more or less whitish talcose gangue gave: PbO 21.74, UO_3 55.50, P_2O_5 10.01, H_2O 5.82, Al_2O_3 , 2.06, CaO 1.32, MgO 2.75, insol. 0.40, sum 99.60%. Readily soluble in acids. In closed tube gives H_2O . Before blow-pipe gives reactions for Pb only with difficulty. More radioactive than kasolite.

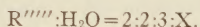
CRYSTALLOGRAPHIC AND OPTICAL PROPERTIES: System evidently tetragonal. Under the microscope it is seen to be made up of minute square plates, which are isotropic, but show double refraction when tilted on edge. Refractive indices greater than 1.74.

PHYSICAL PROPERTIES: Color canary yellow. Structure pulverulent to compact. Sp. gr. 4.08.

OCCURRENCE: As an impregnation in specimens of torbernite from Kasolo, Katanga, Belgian Congo.

DISCUSSION: In spite of the incomplete data, it seems evident that this mineral is a new member of the uranite group, $R''(UO_2)_2[XH_2O](RO_4)_2$. E. T. W.

FAMILY: PHOSPHATES, ARSENATES, ETC. DIVISION: R'' : R''' :



Melanovanadite

W. LINDGREN, L. F. HAMILTON, AND C. PALACHE: Melanovanadite, a new mineral from Mina Ragra, Pasco, Peru. *Proc. Nat. Acad. Sci.*, **7**, (8) 249-251, 1921; *Am. J. Sci.* [5] **3**, 195-203, 1922.

NAME: "In allusion to its being practically the only vanadium mineral of a deep black color"; from the Greek *melanos*, black, and *vanadite* "an obsolete form of vanadinite."

CHEMICAL PROPERTIES: *Formula*, approximately $2CaO : 2V_2O_4 : 3V_2O_5 : XH_2O$, or $Ca_2(VO)_4(V_2O_4)_3XH_2O$. Analysis gave V_2O_5 52.61, V_2O_4 33.34, CaO 9.89, MgO 0.27, $Al_2O_3 + Fe_2O_3$ 1.89, SiO_2 1.66, sum 99.66%. Determinations of total water in a sample kept for several months in a warm dry room gave only 0.42%, which is less than the error of weighing a heavy calcium chloride tube, so the mineral was at first supposed to be anhydrous. Schaller reported, however, in the same material a considerable amount of water, and reanalysis gave: V_2O_5 49.38, V_2O_4 33.48, CaO 10.65, $Fe_2O_3 + Al_2O_3$ 1.39, $H_2O + 5.90$, sum 100.80%. The water content evidently varies with the humidity of the atmosphere and its rôle is uncertain. Before the blowpipe the mineral fuses easily to a brown liquid, giving bead tests for V but no Ca flame. It dissolves readily in dilute acids and is decomposed by KOH.

CRYSTALLOGRAPHIC PROPERTIES: Monoclinic. $a:b:c = 0.4737:1:0.5815$; $\beta = 88^\circ 37\frac{1}{2}'$. $p_0 = 1.227$, $q_0 = 0.581$. Forms, (010), (230), (530) or (210), ($\bar{1}01$), (012), (032), (111), and ($\bar{1}21$). Habit, prismatic and striated; reflections poor and measurements only approximate.

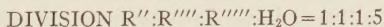
OPTICAL PROPERTIES: Under the microscope translucent and brown only in thinnest prisms. Refractive index α a little less than 1.74, but the others can not be measured, altho the double refraction is strong. Maximum extinction 15° . The extreme absorption prevents determination of further data.

PHYSICAL PROPERTIES: Color black. Luster, almost submetallic. Streak, very dark reddish brown. Hardness 2.5. Specific gravity 3.477. Form, acicular crystals, generally under 0.5 mm. thick. Cleavage (010) perfect.

OCCURRENCE: Collected by W. S. Hutchinson from No. 1 tunnel in the lower part of the patronite deposit at Mina Ragra. Occurs on altered shale containing patronite or other vanadium compounds. Probably formed by the action of $CaCO_3$ on solutions of vanadyl sulfate arising from oxidation of the sulfides. Mineralogical data given indicate that more work on patronite and associated minerals should be done. Alters into orange pascoite.

DISCUSSION. Although this undoubtedly represents a new species, it is to be regretted that the chemical and optical data are not entirely satisfactory; however, more material will probably be found and thus permit further study. As mine air is usually moist, the *original* mineral no doubt contains considerable water.

E. T. W.



Sincosite

W. T. SCHALLER: Sincosite, a new mineral (Preliminary note). *J. Wash. Acad. Sci.*, **12**(8), 195, 1922.

NAME: From the locality, *Sincos*, Peru.

CHEMICAL PROPERTIES: *Formula*, $\text{CaO}:\text{V}_2\text{O}_4:\text{P}_2\text{O}_5:5\text{H}_2\text{O}$ or $\text{Ca}(\text{VO})_2 [5\text{H}_2\text{O}] (\text{PO}_4)_2$. Theory, CaO 12.3, V_2O_4 36.6, P_2O_5 31.3, H_2O 19.8%. Analysis, CaO 12.1, V_2O_4 36.3, P_2O_5 31.7, H_2O 19.9, insol. 0.3, sum 100.3%.

CRYSTALLOGRAPHIC AND OPTICAL PROPERTIES: Tetragonal, in rectangular plates; uniaxial, negative; or in part biaxial.

PHYSICAL PROPERTIES: Color green.

OCCURRENCE: In a black carbonaceous shale.

DISCUSSION: Seems to belong in the uranite group, the (VO) taking the place of the (UO_2) in the commoner members. Full description is to be published elsewhere.

E. T. W.

ABSTRACTS—MINERALOGY

PREHNITE FROM ADAMS SOUND, ADMIRALTY INLET, BAFFIN ISLAND, FRANKLIN. R. A. A. JOHNSTON. *Canada Geol. Surv., Victoria Memorial Museum, Bull.* 1.

An analysis of a pale green prehnite with index of refraction >1.60 and birefringence >0.20 , gave: SiO_2 44.35; Al_2O_3 19.44; Fe_2O_3 6.58; CaO 25.50; H_2O 4.00. However, a small amount of admixed quartz (4.38%) adhered to specimen. Owing to the high content of iron the term *ferro prehnite* was suggested. E. T. W.

THE LIMITS OF MIX-CRYSTAL FORMATION IN THE MINERALS OF THE EPIDOTE GROUP. W. EITEL. *Neues Jahrb. Min. Geol., Beil.-Bd.* 42, 173-222, 1918; *ibid.*, 223-71; thru *Min. Abst.* 1, 246, 1921.

A large number of analyses of zoisite and epidote; piedmontite and orthite were plotted in four and six dimensions, respectively, and the limits of miscibility discussed. E. F. H.

THE ORIGIN OF THE METEORITIC IRONS OF PALLAS AND CANYON DIABLO. STANISLAS MEUNIER. *Bull. soc. géol. France*, [4] 18, 202-213, 1918; through *Rev. Géol.*, 1 (10), 382-383, 1920.

The features of certain iron meteorites indicate that they have not been formed by fusion, but that their metal has been deposited in veins, perhaps by the action of hydrogen on volatile iron and nickel chlorides. E. T. W.

ASBESTOS IN THE UNION OF SOUTH AFRICA. A. L. HALL. *Mem. Geol. Survey Union S. Africa*, 12, 152 pp., 1918.

In addition to the portion of this paper already abstracted in connection with the report of the supposed new mineral "amosite" (*Am. Min.* 5 (1), 16, 1920), full descriptions are given of the occurrence of the well-known crocidolite, of chrysotile and of tremolite asbestos. Analyses of "amosite" are included. E. T. W.

THE SCAPOLITES. NILS SUNDIUS. *Bull. Geol. Inst. Univ. Upsala*, 16, 91-106, 1918; through *Neues Jahrb. Min. Geol.*, 1919, I, Ref. 140-142.

A continuation of previous work, abstracted in *Am. Min.*, 5 (1), 21, 1920. Carbonate marialite is written $\text{NaHCO}_3 \cdot 3\text{NaAlSi}_3\text{O}_8$ and sulfate marialite as $\text{NaHSO}_4 \cdot 3\text{NaAlSi}_3\text{O}_8$. Analyses of several occurrences are recalculated into their mineral compositions, considerable amounts of carbonate and sulfate-bearing molecules being present. The carbonate-scapolites are not markedly different optically from the sulfate-scapolites ($\omega = 1.58-1.59$, $\epsilon = 1.55-1.56$). E. T. W.

TITANIUM-BEARING CORUNDUM SPINELLITE (ROCK EMERY); A PRELIMINARY STATEMENT OF ITS OCCURRENCE AND COMPOSITION IN VIRGINIA. T. L. WATSON AND G. STEIGER. *J. Wash. Acad. Sci.*, **8**, 665-676, 1918.

A microscopic study of 50 thin sections shows it to consist of spinel (pleonaste-50% or more), magnetite, and corundum, with some ilmenite and minor amounts of sillimanite, andalusite, chlorite, and probably corundophyllite. The spinel corresponds to the formula $(\text{Fe}, \text{Mg})\text{O} \cdot (\text{Al}, \text{Fe})_2\text{O}_3$, in which the FeO is molecularly greater than MgO, and Fe_2O_3 is about $\frac{1}{8}$ of the Al_2O_3 . The name spinellite, applied to the titaniferous-iron-spinel ores in northern Sweden, is considered also applicable to this rock mass.

W. F. H.

THE ANTIMONIAL SILVER-LEAD VEINS OF THE ARABIA DISTRICT, NEVADA. ADOLPH KNOFF. *U. S. Geol. Survey, Bull.* **660**, 249-255, 1918.

The chief ore of this district is a silver-bearing bindheimite (hydrous antimonate of lead) which is found in veins cutting granodiorite and hornfels. The bindheimite occurs in two forms, either as a yellow-brown amorphous mineral gel with brilliant pitchy luster and rhythmic precipitation bands, or as a compact, earthy variety with a divergent columnar structure, pseudomorphous after some sulphide from which the bindheimite was derived. An analysis shows 0.33% silver.

W. F. H.

THE DEPOSITS OF MAGNESIUM CARBONATE IN SPAIN. E. DUPUYDE-LOME AND C. F. MAQUIEIRA-DE-BORBON. *Bol. Inst. geol. España*, **39**, 255-295, 1918; through *Rev. géol.*, **1** (5), 200, 1920.

Deposits of the mineral giobertite are described.

E. T. W.

AMBLYGONITE FROM UTÖ. HELGE BACKLUND. *Geol. Fören. Förh.*, **40**, 757-775, 1918.

Analysis and optical properties are given: $\alpha=1.591$, $\beta=1.605$, $\gamma=1.613$.

W. F. FOSHAG.

THE OPTICAL PROPERTIES OF THE OLIVINE GROUP. NILS H. MAGNUSSON. *Geol. Fören. Förh.*, **40**, 601-627, 1918.

Picrotephroite from Långban containing 18% MgO, gave $\alpha=1.711$, $\gamma=1.740$; tephroite, Pajsberg, $\alpha=1.759$, $\beta=1.786$, $\gamma=1.797$; iron-knebelite, Wester Silberg, $\alpha=1.805$, $\beta=1.838$, $\gamma=1.847$; manganfayalite, Gillinge, $\alpha=1.823$, $\beta=1.864$, $\gamma=1.879$. M. concludes that in the forsterite-tephroite and tephroite-fayalite series the refractive indices do not fall on straight line curves when plotted against composition.

EDW. F. HOLDEN.

THE GENESIS OF THE ORES AT TONOPAH, NEVADA. E. S. BASTIN AND F. B. LANEY. *Prof. Paper, U. S. G. S.*, **104**, 50 pp., 1918.

In the early stages of mineralization the ore minerals were deposited through replacement of the wall rock. Later, when less of the wall rock remained near the vein fractures and when the character of the solutions had changed, certain of the ore minerals, notably galena, were themselves replaced by other ore minerals. The hypogene or primary ores have been modified by oxidation and enrichment through agencies originating near the surface.

W. F. H.

TIN DEPOSITS NEAR IRISH CREEK, VIRGINIA, H. G. FERGUSON. *Virginia Geol. Survey, Bull.* **15**, 19 pp., 1918.

The existence of deposits of cassiterite in the Irish Creek district was known as early as 1846, but exploitation has been intermittent. The SnO_2 -quartz veins are associated with a hypersthene granodiorite. The veins are not continuous and the tin content is very irregular, although some specimens of high grade ore were found.

W. F. H.

THE GROWTH PHENOMENA OF COPPER, SILVER, AND GOLD. A. BEUTELL. *Centr. Min. Geol.*, **1919**, 14-28.

Crystals of silver were produced when Ag_2S , Ag_2Te , or Ag_2Se were heated in contact with silver; copper crystals were formed by heating copper with its sulfide, selenide or telluride; and gold crystals when AuTe_2 or AuSe_2 were heated in contact with silver.

E. F. H.

GLIDING IN JORDANITE. MARGARETE V. GOETZE. *Centr. Min. Geol.*, **1919**, 65-74.

Jordanite, thru gliding on (101), may be either pseudo-orthorhombic or pseudo-hexagonal, while it is actually monoclinic. Natural and artificial gliding was investigated.

E. F. H.

SCAPOLITE FROM THE GEM-BEARING PEGMATITES OF MADAGASCAR. A. LACROIX. *Compt. Rend.*, **169**, 261-264, 1919. Thru *Min. Abstr.*, **19**, 12, 1920.

Yellow scapolite of gem quality associated with beryl, euxenite, and monazite occurs in a pegmatite at Tsarasaotra, on the Tsibohaina River. H 6 $\frac{1}{2}$. Uniaxial and negative. $\omega_{na}=1.5698$, $\epsilon_{na}=1.5490$. Partial analysis shows Cl 1.59, F 0.37, CO_2 2.52-2.71, SrO 0.09, FeO 0.90. C_3CO_3 replaces CaO in the meionite molecule $3\text{CaAl}_2\text{Si}_2\text{O}_8\cdot\text{CaO}$. Cut stones resemble beryl somewhat but may be distinguished by the strength of the double refraction and hardness.

W. F. H.

THE ARAGONITES OF SPAIN. PEDRO CASTRO-BAREA. *Trab. Mus. Nac. Cienc. Nat., geol.*, ser., **24**, 112 pp., 1919; thru *Rev. géol.* **1** (6), 223, 1920.

A monograph on the mineral aragonite, in which the Spanish localities are described in special detail. A new twinning law is described, and the presence of magnesium in some specimens noted.

E. T. W.

VESUVIANITE IN ITS CHEMICAL RELATIONSHIPS. GUSTAV TSCHERMAK. *Sitzb. Akad. Wiss. Wien, M-n. Kl.*, **I**, **128**, No. 4, 25 pp., 1919.

Vesuvianite is found to be composed chiefly of a garnet molecule, $\text{Ca}_3\text{Al}_2\text{Si}_3\text{O}_{12}$, with minor amounts of $\text{H}_2\text{R}_3\text{Si}_2\text{O}_8$, $\text{H}_2\text{R}_2\text{Al}_2\text{SiO}_8$, $\text{H}_2\text{R}_3\text{Si}_4\text{O}_{12}$ and $\text{H}_2\text{R}_3\text{SiO}_6$. The tetragonal symmetry is believed to be connected with the presence of the garnet in groups of 4 molecules, while the partial monoclinic features the mineral shows are connected with the monoclinic arrangement of the atoms in the other molecules.

E. T. W.